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# SCIENCE

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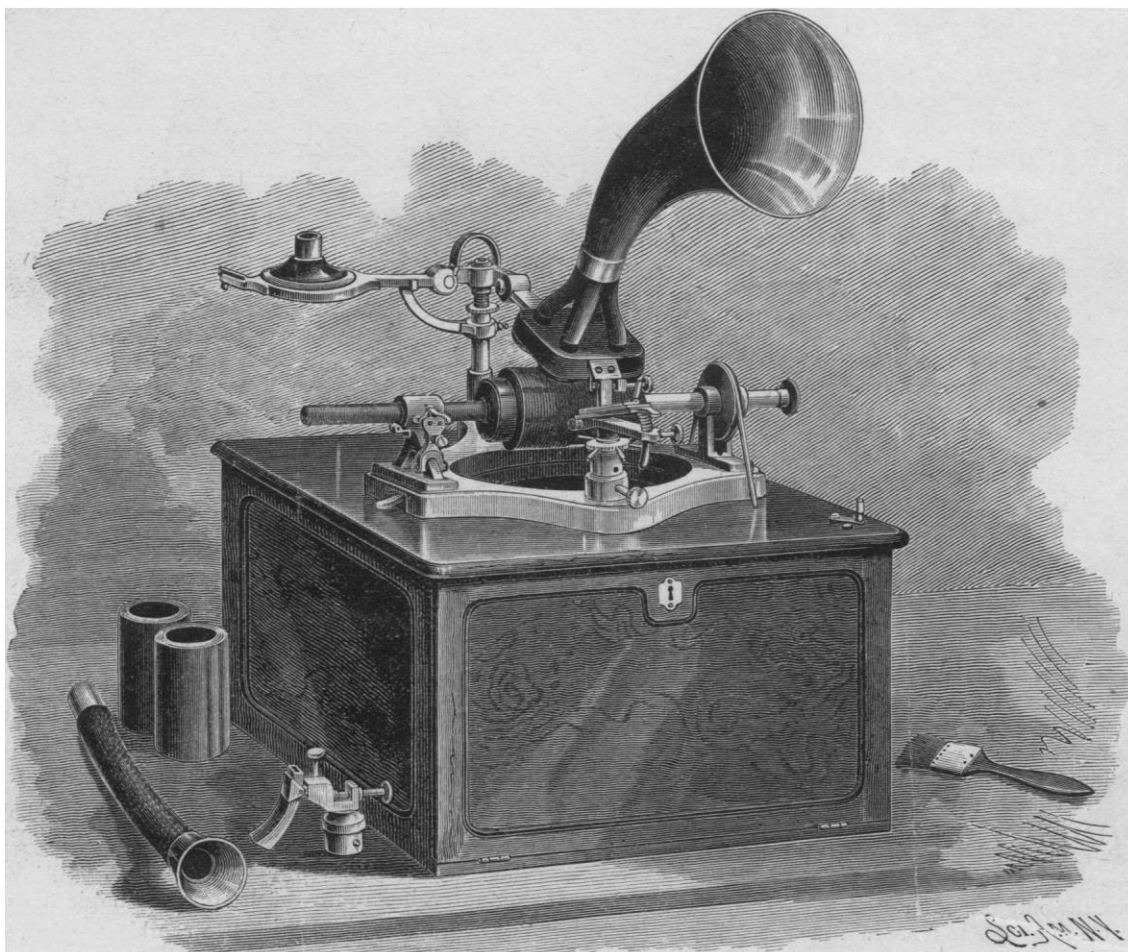
## THE MICRO-GRAPHOPHONE.

IN the construction of my talking-machine, which I call the micro-graphophone, my object was to record articulate speech and other sounds, and reproduce them more distinctly, more naturally, and with greater volume, in order to obviate the necessity of hearing-tubes, and to be sure always of having a good record made and a good reproduction.

My experiments have shown me that to attain these ends there

points, called "nodes,"—points where the vibrations are indistinct or dead. If Tyndall and other scientists are correct (which I think will not be disputed), if a knife is attached to only one point on the diaphragm, the point selected may sometimes be dead or nearly dead, and consequently the vibrations existing in the plate cannot be correctly recorded. Such a diaphragm may sometimes make a very good record, and sometimes an altogether unsatisfactory one.

Suppose a spider attached to a vibratory body by many legs of



LIEUT. BETTINI'S MICRO-GRAPHOPHONE.

must be changes made as much in the recording device as in the reproducer. In my recorder, instead of attaching the recording knife to one point in the centre of the diaphragm, as in other talking-machines, I use a device which I call a spider, to which the knife is attached, and which has branches or legs of different lengths attached to several points of the diaphragm.

A diaphragm made to vibrate by sound-waves vibrates over its entire surface, but with different degrees of vibration at different points. Tyndall, and other masters of the science of sound, show how a vibrating diaphragm or body is covered with dead

different lengths, six or eight, or more (Figs. 2 and 3). Two or three of the points of attachment may be dead points, and unable to transmit vibrations; but by the others the knife will receive all that is necessary to make a good record.

The spider gives to my device other advantages. It gives more force to the knife in making a record, as this force is concentrated from several points, whereas in other machines it has but one source; further, it gives to the knife great steadiness, which I consider most important; and, further yet, a great advantage is that in my device not only are all the tones recorded, but also

the half-tones, the over-tones, and the intermediate tones. This I am able to demonstrate by mathematical figures.

To recapitulate. In recording articulate speech, or other sounds, I take the vibrations from the body or diaphragm at several points or places, and communicate them by independent conductors to a common point or place, causing the record to be made from this common point or place; and the record thus obtained is a perfect one.

In the reproducing device, instead of a small diaphragm made to vibrate by means of a needle attached in the centre by a point, I have a larger diaphragm (Figs. 1 and 6) divided into several smaller divisions,—three, four, five, or more,—and the vibrations are communicated to these different diaphragms by a spider, having in the centre, on one side, a reproducing needle, and, on the obverse side, legs extending to the centre of each of the smaller divisions.

Thus the method of reproducing articulate or other sound or sounds consists in causing a record of vibration to act at a single point or place, and from this point or place to communicate vibrations by independent conductors to the several diaphragms.

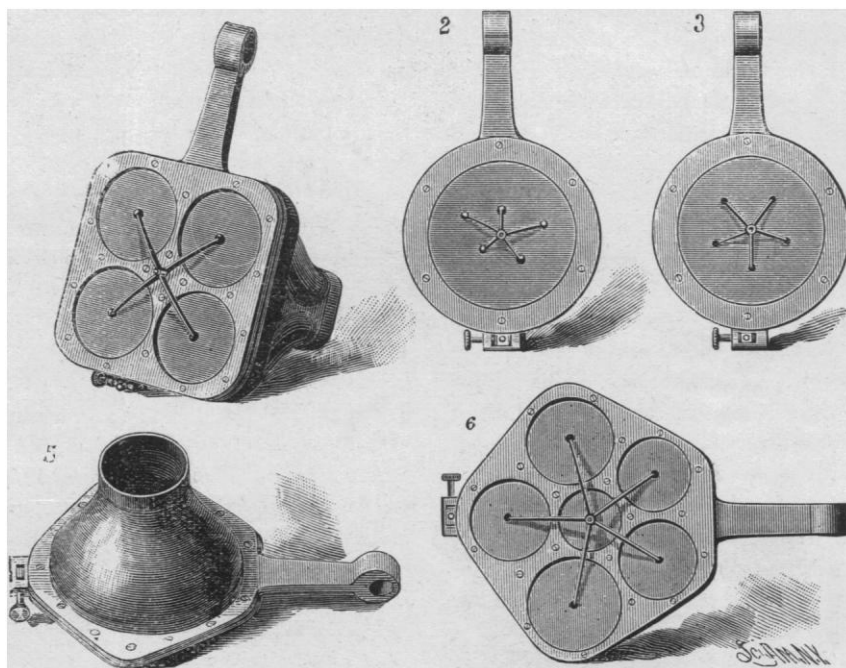
other sounds are always emitted into the room, still retaining all their natural qualities, and each completely distinct and distinguishable.

The micro-graphophone is shown in perspective in the accompanying illustration. In the base is an electro-motor, which, by means of the pulley shown at the right, drives the horizontal shaft carrying the recording cylinders. The illustration shows the reproducing diaphragm in position. The recording diaphragm is swung back, and is seen at the left of the figure. This recording diaphragm is operated by means of a flexible tube, which, with two of the recording cylinders, appear to the left of the base. The other device shown with these is the planing-tool for smoothing the cylinders preparatory to their use.

GIANNI BETTINI.

#### THE SOCIETY AND THE "FAD."

In a very recent issue of a young ladies' magazine (picturesquely called *Poet-Lore*) there lately met my eye the following sentence: "Browning and Ibsen are the only really



DIAPHRAGMS FOR BETTINI'S MICRO-GRAPHOPHONE.

It is very easily seen that a single diaphragm, which is made to vibrate in the centre by a needle attached to one point, will give a minimum result, because the diaphragm only vibrates, with appreciable result for our ears, in a small part of the centre.

A reproducing diaphragm, with a spider attached by its legs at several points, will vibrate over more of its surface; but the best method is to use a diaphragm with several smaller divisions. The result of several diaphragms vibrating at the same time will naturally give more amplitude to the reproduction.

But this is not the only important end attained by this device. It is very desirable to be able to reproduce the exact natural pitch or tone of the voice or other sound.

As with a number of tuning-forks, some of which will gather vibrations where others will not, one diaphragm, also, will take certain vibrations which others are unable to take on account of differences in tensions, dimensions, and other physical conditions.

In my device, having a diaphragm divided into several divisions of different tensions or dimensions, or varying in other physical conditions, I succeed in giving a more natural reproduction, both in volume and in pitch, because, in case unusual vibrations should be reproduced, I have always one or more diaphragms that will sympathize with these vibrations, and no vibration is lost.

With such devices, the micro-graphophone gives a reproduction for which no hearing-tubes are necessary. The voice and all

dramatic authors of their century." As things sometimes strongly suggest their opposites, this sentence reminded me of one of Professor Tyndall's splendid chapters, the one entitled "The Scientific Use of the Imagination;" which chapter quotes as its text the following passage from an address of Sir Benjamin Brodie to the Royal Society: "Physical investigation, more than any thing besides, helps to teach us the actual value and right use of the imagination,—of that wondrous faculty, which, left to ramble uncontrolled, leads us astray into a wilderness of perplexities and errors,—a land of mists and shadows,—but which, properly controlled by experience and reflection, becomes the noblest attribute of man, the source of poetic genius, the instrument of discovery in science, without the aid of which Newton would never have invented fluxions, nor Davy have decomposed the earths and alkalies, nor would Columbus have found another continent."

There is a use of the imagination which is of prophetic value: as, for example, the use which a poet like Goethe makes of it when he foresees, in his poetry, that which the